IEC 62529

Edition 2.0 2012-06

INTERNATIONAL STANDARD

IEEE Std 1641™

colour inside

Standard for Signal and Test Definition



Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

IEC 62529:2012(E) IEEE Std 1641-2010

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2010 IEEE

All rights reserved. IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by the Institute of Electrical and Electronics Engineers, Inc.

Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the IEC Central Office.

Any questions about IEEE copyright should be addressed to the IEEE. Enquiries about obtaining additional rights to this publication and other information requests should be addressed to the IEC or your local IEC member National Committee.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue
New York, NY 10016-5997
United States of America
stds.info@ieee.org
www.ieee.org

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,…).
It also gives information on projects, replaced and withdrawn publications.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

This is a Redline Document produced by Techstreet, a business of Thomson Reuters.

This document is intended to provide users with an indication of changes from one edition to the next. It includes a full-text version of the new document, plus an indication of changes from the previous version.

Redlines are designed to save time and improve efficiencies by using the latest software technology to find and highlight document changes. More professionals are using valuable new technologies like redlines, to help improve outcomes in a fastpaced global business world.

Because it may not be technically possible to capture all changes accurately, it is recommended that users consult previous editions as appropriate. In all cases, only the current base version of this publication is to be considered the official document.

Documents Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

Redline Processing Notes:

1. ~~**Red Text**~~ - Red strikethrough text denotes deletions.

2. **Blue Text** - Blue underlined text denotes modifications and additions.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

IEC 62529

Edition 2.0 2012-06

INTERNATIONAL STANDARD

IEEE Std 1641™

colour inside

Standard for Signal and Test Definition

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE XM

ICS 25.040; 35.060

ISBN 978-2-83220-103-9

Warning! Make sure that you obtained this publication from an authorized distributor.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

Contents

1. Overview 1
1.1 Scope 1
1.2 Purpose 1
1.3 Application 1
1.4 Annexes 2

2. Definitions, abbreviations, and acronyms 2
2.1 Definitions 2
2.2 Abbreviations and acronyms 4

3. Structure of this standard 5
3.1 Layers 5
3.2 Signal Modeling Language (SML) layer 6
3.3 BSC layer 6
3.4 TSF layer 6
3.5 Test requirement layer 6
3.6 Using the layers 7

4. Signals and SignalFunctions 7
4.1 Introduction 7
4.2 Physical signal states 8
4.3 Event states 9
4.4 Digital stream states 9

5. SML layer 10

6. BSC layer 11
6.1 BSC layer base classes 11
6.2 General description of BSCs 11
6.3 SignalFunction template 12

7. TSF layer 12
7.1 TSF classes 13
7.2 TSF signals defined by a model 13
7.3 TSF signals defined by an external reference 16

8. Test procedure language (TPL) 16
8.1 Goals of the TPL 16
8.2 Elements of the TPL 16
8.3 Use of the TPL 17

9. Maximizing test platform independence 17

Annex A (normative) Signal modeling language (SML) 18
A.1 Use of the SML 18
A.2 Introduction 18
A.3 Physical types 19
A.4 Signal definitions 22
A.5 Pure signals 24
A.6 Pure signal-combining mechanisms 26
A.7 Pure function transformations 32

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

A.8 Measuring, limiting, and sampling signals 32
A.9 Digital signals 34
A.10 Basic component SML 38
A.11 Fast Fourier analysis support 63

Annex B (normative) Basic signal components (BSC) layer 65
B.1 BSC layer base classes 65
B.2 BSC subclasses 65
B.3 Description of a BSC 69
B.4 Physical class 76
B.5 PulseDefns class 87
B.6 SignalFunction class 89

Annex C (normative) Dynamic signal descriptions 143
C.1 Introduction 143
C.2 Basic classes 144
C.3 Dynamic signal goals and use cases 152

Annex D (normative) Interface definition language (IDL) basic components 153
D.1 Introduction 153
D.2 IDL BSC library 153

Annex E (informative) Test signal framework (TSF) for C/ATLAS 154
E.1 Introduction 154
E.2 TSF library definition in extensible markup language (XML) 154
E.3 Interface definition language (IDL) for the TSF for C/ATLAS 154
E.4 AC_SIGNAL<type: Current|| Power|| Voltage> 155
E.5 AM_SIGNAL 157
E.6 DC_SIGNAL<type: Voltage|| Current|| Power> 159
E.7 DIGITAL_PARALLEL 161
E.8 DIGITAL_SERIAL 163
E.9 DIGITAL_TEST 165
E.10 DME_INTERROGATION 168
E.11 DME_RESPONSE 171
E.12 FM_SIGNAL<type: Voltage|| Power|| Current> 174
E.13 ILS_GLIDE_SLOPE<type: Voltage|| Power> 177
E.14 ILS_LOCALIZER<type: Power|| Voltage> 180
E.15 ILS_MARKER 183
E.16 PM_SIGNAL 186
E.17 PULSED_AC_SIGNAL<type: Current|| Power|| Voltage> 188
E.18 PULSED_AC_TRAIN<type: Voltage|| Current|| Power> 190
E.19 PULSED_DC_SIGNAL<type: Voltage|| Current|| Power> 192
E.20 PULSED_DC_TRAIN<type: Voltage|| Current|| Power> 194
E.21 RADAR_RX_SIGNAL 196
E.22 RADAR_TX_SIGNAL<type: Current|| Voltage|| Power> 199
E.23 RAMP_SIGNAL<type: Voltage|| Current|| Power> 200
E.24 RANDOM_NOISE 202
E.25 RESOLVER 204
E.26 RS_232 207
E.27 SQUARE_WAVE<type: Current|| Voltage|| Power> 208
E.28 SSR_INTERROGATION<type: Voltage|| Current|| Power> 210
E.29 SSR_RESPONSE<type: Voltage|| Current|| Power> 213
E.30 STEP_SIGNAL 217
E.31 SUP_CAR_SIGNAL 219
E.32 SYNCHRO 221
E.33 TACAN 225

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

E.34 TRIANGULAR_WAVE_SIGNAL<type: Voltage|| Current|| Power> 229
E.35 VOR 231

Annex F (informative) Test signal framework (TSF) library for digital pulse classes 235
F.1 Introduction 235
F.2 TSF library definition in extensible markup language (XML) 235
F.3 Graphical models of TSFs 235
F.4 Pulse class family of TSFs 235
F.5 DTIF 252

Annex G (normative) Carrier language requirements 254
G.1 Carrier language requirements 254
G.2 Interface definition language (IDL) 254
G.3 Datatypes 254
G.4 Data-processing requirements 259
G.5 Control structures 263

Annex H (normative) Test procedure language (TPL) 265
H.1 TPL layer 265
H.2 Elements of the TPL 265
H.3 Structure of test requirements 265
H.4 Carrier language 265
H.5 Signal statements 265
H.6 Mapping of test statements to carrier language 267
H.7 Test statement definitions 267
H.8 Elements used in test statement definitions 285
H.9 Attributes with multiple properties 288
H.10 Transferring data in digital signals 292
H.11 Creating test requirements 296
H.12 Delimiting TPL statements 298

Annex I (normative) Extensible markup language (XML) signal descriptions 300
I.1 Introduction 300
I.2 XSD for BSCs 301
I.3 XSD for TSFs 302

Annex J (informative) Support for ATLAS nouns and modifiers 308
J.1 Signal and test definition (STD) support for ATLAS signals 308
J.2 STD support for ATLAS nouns 308
J.3 STD support for C/ATLAS noun modifiers 311
J.4 Support for C/ATLAS extensions 319

Annex K (informative) Guide for maximizing test platform independence and test application interchangeability 320
K.1 Introduction 320
K.2 Guiding principles 320
K.3 Best practice rules 320

Annex L (informative) Bibliography 323

Annex M (informative) IEEE List of Participants 325

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

Standard for Signal and Test Definition

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation.

   IEEE Standards documents are developed within IEEE Societies and Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. IEEE develops its standards through a consensus development process, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of IEEE and serve without compensation. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards. Use of IEEE Standards documents is wholly voluntary. IEEE documents are made available for use subject to important notices and legal disclaimers (see http://standards.ieee.org/IPR/disclaimers.html for more information).

   IEC collaborates closely with IEEE in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees. The formal decisions of IEEE on technical matters, once consensus within IEEE Societies and Standards Coordinating Committees has been reached, is determined by a balanced ballot of materially interested parties who indicate interest in reviewing the proposed standard. Final approval of the IEEE standards document is given by the IEEE Standards Association (IEEE-SA) Standards Board.

3) IEC/IEEE Publications have the form of recommendations for international use and are accepted by IEC National Committees/IEEE Societies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC/IEEE Publications is accurate, IEC or IEEE cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications (including IEC/IEEE Publications) transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC/IEEE Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC and IEEE do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC and IEEE are not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or IEEE or their directors, employees, servants or agents including individual experts and members of technical committees and IEC National Committees, or volunteers of IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board, for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC/IEEE Publication or any other IEC or IEEE Publications.

8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that implementation of this IEC/IEEE Publication may require use of material covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. IEC or IEEE shall not be held responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patent Claims or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

International Standard IEC 62529 / IEEE Std 1641-2010 has been processed through IEC technical committee 93: Design automation, under the IEC/IEEE Dual Logo Agreement.

This second edition cancels and replaces the first edition, published in 2007, and constitutes a technical revision.

The text of this standard is based on the following documents:

IEEE Std	FDIS	Report on voting
IEEE Std 1641-2010	93/322/FDIS	93/329/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

IEEE Std 1641™-2010
(Revision of
IEEE Std 1641-2004)

IEEE Standard for Signal and Test Definition

Sponsor

IEEE Standards Coordinating Committee 20 on Test and Diagnosis for Electronic Systems

Approved 17 June 2010

IEEE-SA Standards Board

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

Abstract: This standard provides the means to define and describe signals used in testing. It also provides a set of common basic signals, built upon formal mathematical specifications so that signals can be combined to form complex signals usable across all test platforms.

Keywords: ATE, ATLAS, automatic test equipment, IEEE 1641, signal definitions, test definitions, test requirements, test signals, unit under test, UUT

IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by the Institute of Electrical and Electronics Engineers, Incorporated.

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

IEEE Introduction

This introduction is not part of IEEE Std 1641-2010, IEEE Standard for Signal and Test Definition.

This signal and test definition (STD) standard provides the ability to unambiguously define test signals. It includes a rigorous mathematical and definitive foundation for all of its signal components. Any signal defined using this standard will be the same regardless of the equipment is used to create it. The standard supports the implementation of new technologies by providing users with the ability to describe their own signals by combining existing signals. Thus, any desired signal may be described, and there is no limit on the extensibility of signals supported by this standard.

Signals defined using this standard can be used in a programming environment of the user's choice provided that that environment fulfills the minimum requirements defined in this standard. This universality enables the user to take full advantage of modern program structures and development environments, including graphical programming environments.

This standard was developed by the Test and ATS Description Subcommittee (of the IEEE Standards Coordinating Committee 20 (SCC20) on Test and Diagnosis for Electronic Systems), which has prepared a companion guide, IEEE Std 1641.1™, to explain how to implement signal definitions and test requirements in conformance with STD.

Notice to users

Laws and regulations

Users of these documents should consult all applicable laws and regulations. Compliance with the provisions of this standard does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

This document is copyrighted by the IEEE. It is made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making this document available for use and adoption by public authorities and private users, the IEEE does not waive any rights in copyright to this document.

Updating of IEEE documents

Users of IEEE standards should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect. In order to determine whether

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE Standards Association web site at http://ieeexplore.ieee.org/xpl/standards.jsp, or contact the IEEE at the address listed previously.

For more information about the IEEE Standards Association or the IEEE standards development process, visit the IEEE-SA web site at http://standards.ieee.org.

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/reading/ieee/updates/errata/index.html. Users are encouraged to check this URL for errata periodically.

Interpretations

Current interpretations can be accessed at the following URL: http://standards.ieee.org/reading/ieee/interp/index.html.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or nondiscriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Published by IEC under license from IEEE. © 2010 IEEE. All rights reserved.

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

Standard for Signal and Test Definition

IMPORTANT NOTICE: This standard is not intended to ensure safety, security, health, or environmental protection. Implementers of the standard are responsible for determining appropriate safety, security, environmental, and health practices or regulatory requirements.

This IEEE document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notice" or "Important Notices and Disclaimers Concerning IEEE Documents." They can also be obtained on request from IEEE or viewed at http://standards.ieee.org/IPR/disclaimers.html.

1. Overview

~~This standard, also known as the signal and test definition (STD) standard, is the culmination of a radical review of the Abbreviated Test Language for All Systems (ATLAS) test programming language and the requirement to create truly portable test requirements. STD will allow test information to pass more freely between the design, test, and maintenance phases of a project, enabling the same information to be used directly across project phases. This more efficient use of information will lead to reduced life-cycle costs.~~

~~STD provides the capability to describe and control signals, while permitting a choice of operating environment, including the choice of carrier language. STD permits signal operations to be embedded in any object-oriented environment and thus to be used by the architecture standards of various automatic test systems (ATSs).~~

~~Portability is extended beyond that of test specifications by virtue of a layered architecture.~~

Documents
Document Sharing Hub

Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.

Full document details: IEEE 62529-2012

~~STD defines a collection of objects and their interfaces. These objects describe signal components relevant to test requirements. The STD standard defines how to interconnect these objects using interfaces, through which the objects exchange information, so that a test model may be defined that describes actual test requirements.~~

~~Finally, the link to published ATLAS standards (such as IEEE Std 716™ 1995 [B9][3]) is preserved in that the user can describe signal operations using very similar test signal related keywords. These keywords now have formal definitions. Furthermore, the parameters of the signals themselves also have a rigorous formal behavioral description.~~

1.1 Scope

This standard provides the means to define and describe signals used in testing. It ~~also~~ provides a set of common basic signal definitions, built upon formal mathematical specifications, ~~mathematically underpinned~~ so that signals can be combined to form complex signals usable across all test platforms. The standard provides support for structural textual languages and programming ~~provision of~~ language interfaces ~~elements supports test signal descriptions~~ for interoperability.

~~*This* standard is divided into seven clauses:~~

- ~~Clause 1 provides an introduction to this standard.~~
- ~~Clause 2 provides definitions of terms and lists abbreviations.~~
- ~~Clause 3 describes the structure of the STD standard.~~
- ~~Clause 4 specifies the signal modeling language (SML).~~

[3] The numbers in brackets correspond to the numbers of the bibliography in Annex L.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

— Clause 5 specifies the STD basic signal components (BSCs).

— Clause 6 defines the test signal frameworks (TSFs).

— Clause 7 describes the test procedure language (TPL) layer.

This standard also contains the following annexes:

a) Annex A provides the Signals Modeling Language that is used to construct the BSCs and the TSFs.

b) Annex B provides BSC descriptions.

c) Annex C provides dynamic signal model description, states, and state transitions.

d) Annex D provides the interface definition language (IDL) description for the BSCs.

e) Annex E provides a TSF. This framework provides a formal description of signals similar to the signals defined in IEEE Std 716-1995. It also serves to illustrate how complex test signal models can be built up from BSCs.

f) Annex F provides the IDL description for the TSF provided in Annex E.

g) Annex G defines the requirements for a carrier language.

h) Annex H provides the formal TPL description.

i) Annex I provides the extensible markup language (XML) description mapping signal models into XML descriptions.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

~~j) Annex J provides XML description mapping the TSF provided in Annex E into XML descriptions.~~

~~k) Annex K provides a description of how ATLAS nouns and noun modifiers are supported by STD.~~

~~l) Annex L provides a bibliography of related documents.~~

1.2 Purpose

This standard provides a common reference for signal definitions, which may be used throughout the life cycle of a unit under test (UUT) or test system. Such a reference will in turn facilitate information transfer, test reuse, and broader application of test information—accessible through commercially available development tools.

1.3 Application

This signal and test definition (STD) standard provides the capability to describe and control signals, while permitting a choice of operating environment, including the choice of carrier language. STD permits signal operations to be embedded in any object-oriented environment and thus to be used by the architecture standards of various automatic test systems (ATSs). STD may be used to create truly portable test requirements. It will allow test information to pass more freely between the design, test, and maintenance phases of a project and enable the same information to be used directly across project phases. This more efficient use of information will lead to reduced life-cycle costs.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

1.4 Annexes

This standard also contains annexes that describe various elements of the standard in detail. The normative annexes include definitions of the basic signals (in words and with reference to an extensible markup language (XML) format), supporting mathematical definitions for these signals, dynamic model information, interface definition descriptions, and a definition of the requirements of a supporting computer language.

Informative annexes are provided to present examples of signal libraries together with their associated XML definition.

2. Definitions, abbreviations, and acronyms

2.1 Definitions

For the purposes of this document, the following terms and definitions apply. *The ~~Authoritative Dictionary of~~ IEEE Standards Dictionary: Glossary of Terms & Definitions ~~Terms~~* ~~[B8]~~ should be referenced for terms not defined in this clause.[1]

Abbreviated Test Language for All Systems (ATLAS): A stylized, abbreviated English language used in the preparation and documentation of test requirements and test programs, which can be implemented either manually or with automatic or semi-automatic test equipment.[2]

argument: Input values that can be passed to a function.

[1] *The IEEE Standards Dictionary: Glossary of Terms & Definitions* is available at http://shop.ieee.org/.

[2] In this standard, the term "ATLAS" refers to any version or subset whether it is a formal standardized version or a project specific modified subset.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

attribute: A property value that is used to define signal characteristics or behavior.

automatic test system (ATS): A system that includes the automatic test equipment (ATE) and all support equipment, support software, test programs, and interface adapters.

base class: A class from which another class inherits attributes or properties.

basic signal component (BSC): The lowest level of building block used to define signals.

class: A generic set of predefined abstract test objects.

component: A part of a system, which may be hardware or software and which may be subdivided into other components. Components communicate their functionality through their interface definitions.

connection: The application of a signal to a unit under test (UUT).

data bus: A signal line or set of signal lines used by a data communication system to interconnect a number of devices and to communicate information.

dynamic signal: A signal whose definition changes over time, by use of the control interface. These changes must be initiated with one of the signal method calls or by changing the interconnections of a signal model.

function: A construct that is a logically separated block of code that operates upon test values (i.e., arguments). Another name for a function is method. Syn: method.

interface definition language (IDL): A machine-compilable language that is used to describe the interfaces that software objects call and object implementations provide. The language provides a neutral way to define software interfaces.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

method: *Syn:* **function**.

model: A mathematical or physical representation (i.e., simulation) of system relationships for a process, device, or concept.

physical: Pertaining to the natural characteristics of the universe according to the natural laws of science.

procedural: The part of an signal and test definition (STD) test requirement that defines the tests in the manner and order required for testing.

property: The special form of method (or function) that supports the semantics of assignment (l-value) and reading (r-value).

reserved word: A keyword whose meaning and use are fixed by the semantics of a language. In certain or all contexts, a reserved word cannot be used for any purpose other than as defined for that language.

semantics: A branch of linguistics concerned with meaning. For the test procedure language (TPL), semantics is the connotative meaning of words in an TPL statement. For software, semantics is the relationships of symbols and their meaning, independent of the manner of their interpretation and use. For meta-languages, semantics is the discipline for expressing the meanings of computer-language constructs in a meta-language.

sensor: A transducer that converts a test parameter to a form suitable for measurement.

SignalFunction: The name of the base class, for all classes that provide signals.

Subclass: A class that inherits attributes or properties from a base class.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

static signal: A signal whose definition does not change over time. All basic signal components (BSCs) and test signal framework (TSF) models are static signals.

syntax: The grammatical arrangement of words in a language statement.

system: A set of interconnected hardware and/or software components ~~entities~~ that achieves a defined objective by performing specified functions.

system architecture: The structure of and relationship between the components ~~entities~~ of a system. A system architecture may include the system interface with its operational environment.

template: A pattern or design that establishes the outline, dimensions, or process for subsequent users or implementers.

test: (A) An action or group of actions that are performed on a unit under test (UUT) to evaluate its parameter(s) or characteristic(s). (Derived from IEEE Std 771-1989). (B) An observed activity that may be caused to occur (e.g., stimulus-response) in order to obtain information about the behavior of a test subject. (Derived from IEEE Std 1671-2006). (C) A set of stimuli, either applied or known, combined with a set of observed responses and criteria for comparing these responses to a known standard. (Derived from IEEE Std 1232-2002).

test requirement: A definition of the tests and test conditions required to be performed on a unit under test (UUT) to verify conformance with its performance specification.

test specification: A definition of the tests to be performed on a unit under test (UUT) to verify conformance with its performance specification, with or without fault diagnostics, and without reference to any specific test equipment.

test procedure: A description of the tests, test methods, and test sequences to be performed on a unit under test (UUT) to verify conformance with its test specification, with or without fault diagnostics, and without reference to specific test equipment.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

test program: An implementation of the tests, test methods, and test sequences to be performed on a unit under test (UUT) to verify conformance with its test specification, with or without fault diagnosis. A test program is configured for execution on a specific test system.

transducer: A device that converts a physical magnitude of one form of energy into another form, generally on a one-to-one correspondence or according to a specified mathematical formula.

unit under test (UUT): An entity that can be tested and that may range from a single component to a complete system.

value: The quantitative size of a signal attribute.

2.2 Abbreviations and acronyms

ARB auxiliary reference burst

ARINC Aeronautical Radio, Inc.[2]

ASCII American Standard Code for Information Interchange

ATC air traffic control

ATE automatic test equipment

ATLAS Abbreviated Test Language for All Systems

ATS automatic test system

[2] ~~ARINC provides engineering specifications and services to airlines, airframe constructors, and avionics suppliers.~~

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

BSC	basic signal component
C/ATLAS	Common/Abbreviated Test Language for All Systems (IEEE Std 716™-1995 [B12][3])
DME	distance measuring equipment
DTIF	Digital Test Interchange Format
IDL	interface definition language
IFF	identification, friend, or foe
ILS	instrument landing system
MRB	main reference burst
~~PCS~~	~~piecewise continuous signal~~
PRF	pulse repetition frequency
RF	radio frequency
rms	root mean square
SML	signal modeling language
SSR	secondary surveillance radar
STANAG	NATO Standardization Agreements

[3] The numbers in brackets correspond to the numbers of the bibliography in Annex L.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

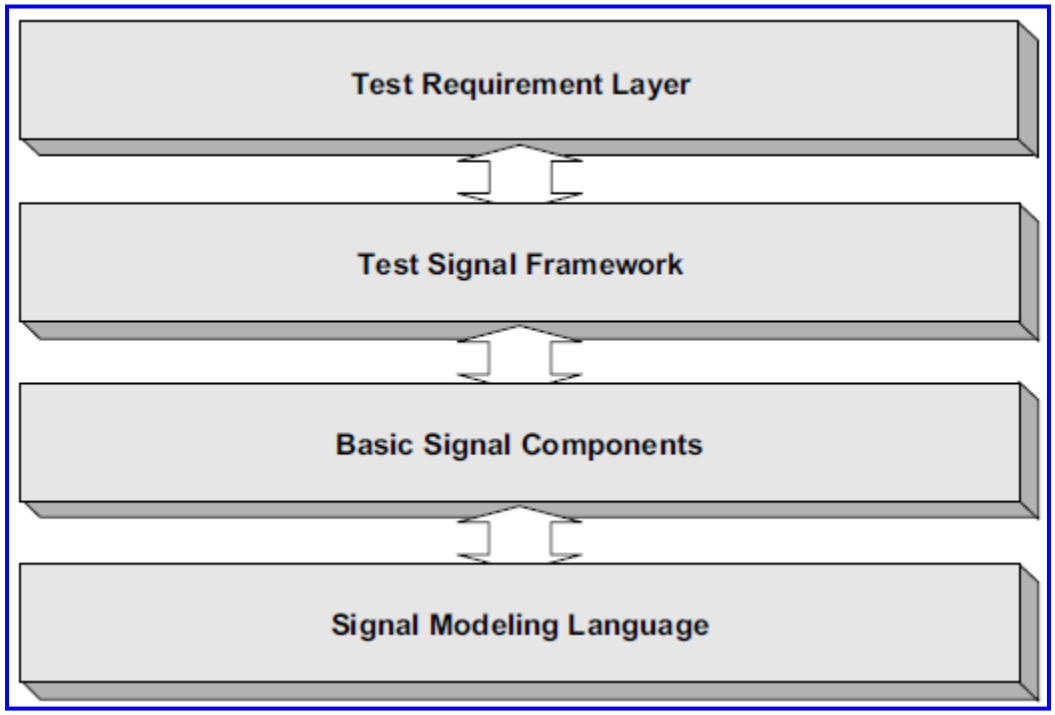
STD	signal and test definition
TACAN	tactical air navigation
trms	true root mean square
TPL	test procedure language
TSF	test signal framework
UHF	ultrahigh frequency
UUT	unit under test
VHF	very high frequency
VOR	VHF omnidirectional range
XSD	XML Schema Definition
~~XMD~~	~~XML signal definition~~
XML	extensible markup language

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

3. Structure of this standard

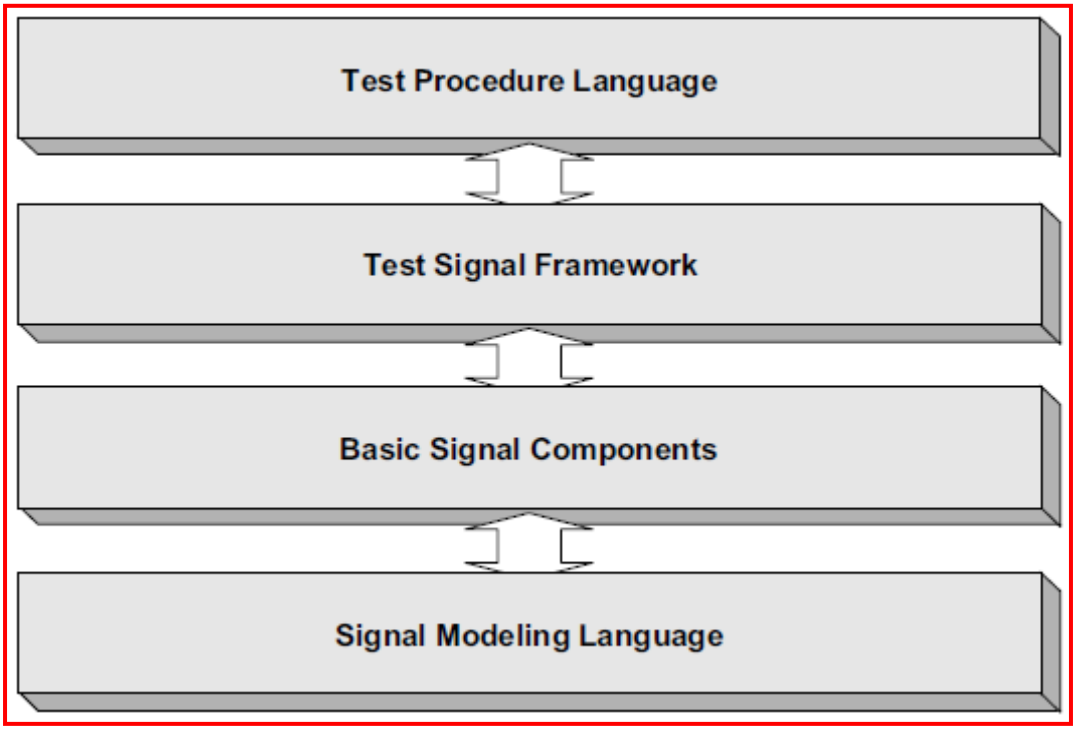
3.1 Layers

This standard has a layered format depicted ~~below~~ in Figure 1. Each layer and its purpose ~~function~~ are described in Clause 3. Each layer builds on items defined in previous layers. This format does not require that each layer use only items in its immediate lower level, but does imply that each layer has to be fully defined in terms of its lower level layers.



(New)

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012



~~(Deleted)~~

Figure 1 —STD layers

~~The layer model provides additional support features over a purely textual language.~~ This standard provides the capability to describe and control signals and allows the user to choose the operating environment, including the choice of programming language. The STD test requirements take the form of signal definitions, which can be written in any programming or declarative language, including XML or object-oriented environment.

The link to Abbreviated Test Language for All Systems (ATLAS) and Common/Abbreviated Test Language for All Systems (C/ATLAS) standards is preserved as test requirements are mapped to signals that have formal definitions tied to the test signal framework (TSF) and basic signal component (BSC) layers. This link comprises an example TSF library for ATLAS (see Annex E) and an annex showing how ATLAS NOUNS and NOUN MODIFIERS may be supported (see Annex J).

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

3.2 Signal Modeling Language (SML) layer

The SML layer provides the mathematical definitions that support the description of BSCs. This mathematical underpinning provides evidence that the signals ~~are~~ defined by BSCs can be functionally compared and simulated. The SML signal definitions form the basis for reuse that is essential to the extension of STD capabilities without a corresponding explosion in nomenclature and complexity.

3.3 BSC layer

The BSC layer provides reusable, formally described, fundamental signal classes. These classes define the lowest level of signal building blocks available to the STD environment. Each BSC is described by its class name, class type, properties and default values, XML Schema definitions (XSDs), interface definition language (IDL) description, and SML signal definition.

3.4 TSF layer

The TSF layer identifies how libraries of reusable, formally described signal classes are defined. The content of a TSF library is a collection of domain-specific signal definitions made up from other TSF signals and/or BSCs.

The TSF layer provides for TSF libraries, which are ~~is~~ the extendibility mechanism that allows the creation of additional signal class definitions. Each TSF class within a TSF library is described by its class name, class type, properties and default values, XML ~~IDL~~ description containing an interface definition in XML, a static signal model definition, and a textual description from which an IDL interface and XSD can be derived.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

A TSF library may contain TSF classes, which themselves refer to other TSF classes. In order that the library definition is complete, any TSF classes so referenced shall be provided.

3. 5 Test requirement ~~TPL~~ layer

The test requirement ~~TPL~~ layer allows test descriptions (e.g., test requirements, test procedures, ~~or~~ test programs) to be formally described ~~in a textual format~~ by combining STD signals with features that satisfy the carrier language requirements (see Annex G).

Test specifications and signal libraries conforming to the requirements of this layer may be ported between different ATSs with the same functional capability and carrier language. Minimal translation would be required to convert between different carrier languages.

The signals may be described using XML, calls to the IDL interface, or the STD-specific test procedure language (TPL). The TPL allows test actions to be formally described in a stylized textual format suitable for preprocessing into a target carrier language

3.6 Using the layers

A user need only refer to the layers that are required to directly support a signal or test that needs to be defined. In many cases, only BSCs and TSFs are required to describe a signal using, for example, XML descriptions. Signal descriptions may be reused as required with different attribute values. They are created when required and destroyed when their function is complete, e.g., a signal used in a measurement is destroyed when the measurement is complete (unless otherwise determined in the test). The states that signals, events, and digital streams can take are outlined in Clause 3 and explained in detail in the normative annexes.

All names used for entities defined in this standard are case sensitive, e.g., signal names, attribute names. However, names of elements within the same scope shall not be differentiated solely by case.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

4. Signals and SignalFunctions

4.1 Introduction

Throughout all the layers, there exists the concept of signals. Signals are the outputs from SignalFunctions, where SignalFunctions are interconnected and built up as required to provide the required signal characteristics. The signal is considered "physical" only when it is used, e.g., when applied to a UUT pin interface. By definition BSCs are SignalFunctions. SignalFunctions are characterized by their type, which may be typeless, generic, or abstract or may map onto a physical type ~~property~~. Examples of typeless SignalFunctions are events. Generic SignalFunctions (such as Sum) inherit their type from their inputs. Abstract SignalFunctions provide typeless value information (such as RMS sensor). An example of a type that maps onto a physical type ~~property~~ is Voltage, such as in a Sinusoidal signal of type Voltage. The type of a SignalFunction also includes the reference type; most signals encountered in this standard have the reference type Time. Therefore, a Sinusoidal Voltage signal describes how the signal's voltage changes with respect to time, in a sinusoidal manner. The use of types is such that SignalFunctions can be combined to build signals only when they have compatible types such as ~~only when they have the same types or~~ when one or more of the types are typeless, abstract, or generic or where the different signal types can be provided independently. Types that appear different and that represent a transform are allowed, as they represent a different method of specifying the same signal, e.g., Sinusoid (Voltage, Frequency) with Sinusoid (Voltage, Time). An example of an illegal signal definition is one in which both current and voltage are specified because both cannot be controlled independently. Extendibility is served by providing the capability to describe new signals formally by creating them from the existing signals in either the TSF or BSC layer. SignalFunctions are described in detail in Annex B.

NOTE—The standard does allow a voltage to be specified together with a current limit (or vice versa) because limit signals are generic types.[4]

[4] Notes in text, tables, and figures are given for information only and do not contain requirements needed to implement this standard.

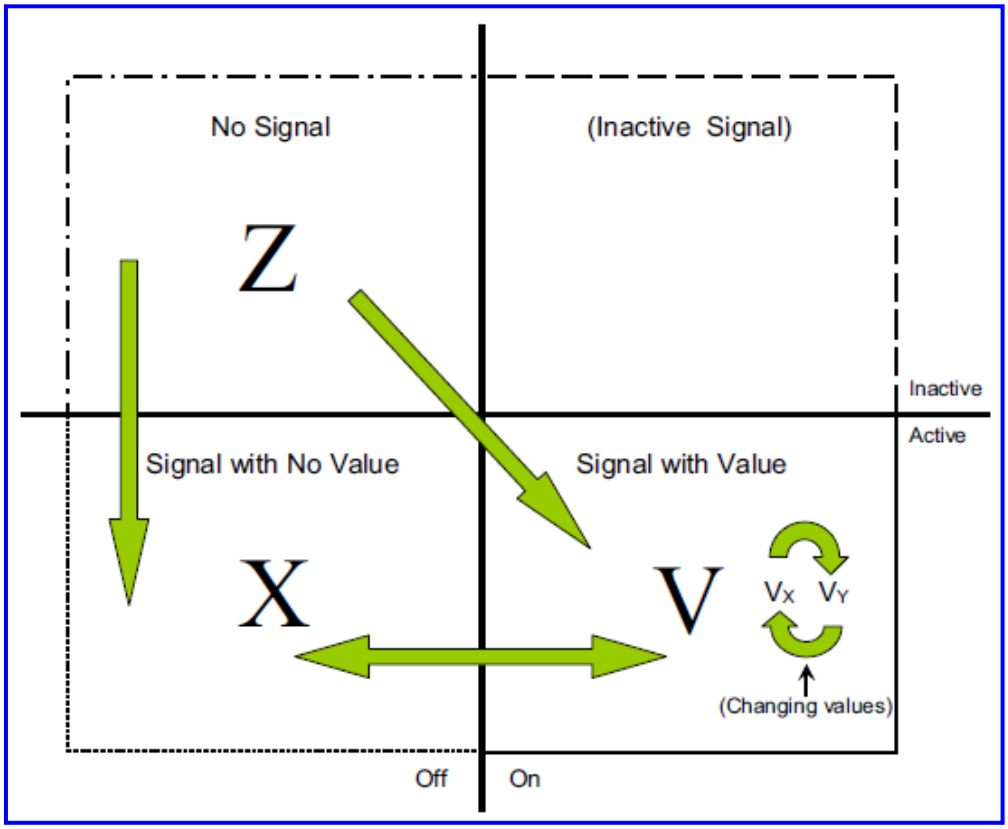
Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

A physical signal, event, or digital stream element may be active or inactive and also may be controlled by events, i.e., it may be gated on or off. Thus, there are four possible states that may be adopted: active & gated on, active & gated off, inactive & gated on, or inactive & gated off. Not all four states are applicable to all signals, events, and digital elements. The states that can be adopted by each may be illustrated diagrammatically (see Figure 2, Figure 3, and Figure 4). These figures provide a simplified indication of the states that can be attained by a sources. The states attained by conditioners will also depend upon the signals on their inputs.

4.2 Physical signal states

Figure 2 shows the states available to a signal. Before a signal exists, it may be considered to be in the "No Signal" (Z) state. When it is invoked, it passes into the active state and, in the simplest case, will appear with its specified value (V), i.e., the "Signal with Value" state in Figure 2. The value may be changed while the signal exists, as indicated in Figure 2 by the value changing from V_X to V_Y and so on. If the signal is provided with a gate, the signal may be gated on and off by external events. When the signal is gated on, the signal is output with its specified value. When gated off, the signal has no value, i.e., the signal is active but nothing is known about its value. When subsequently gated on again, the signal appears with its current value. In other words, the value may have changed while it was gated off, but cannot be determined until is it gated on again.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012



(New)

Figure 2 —Signal states

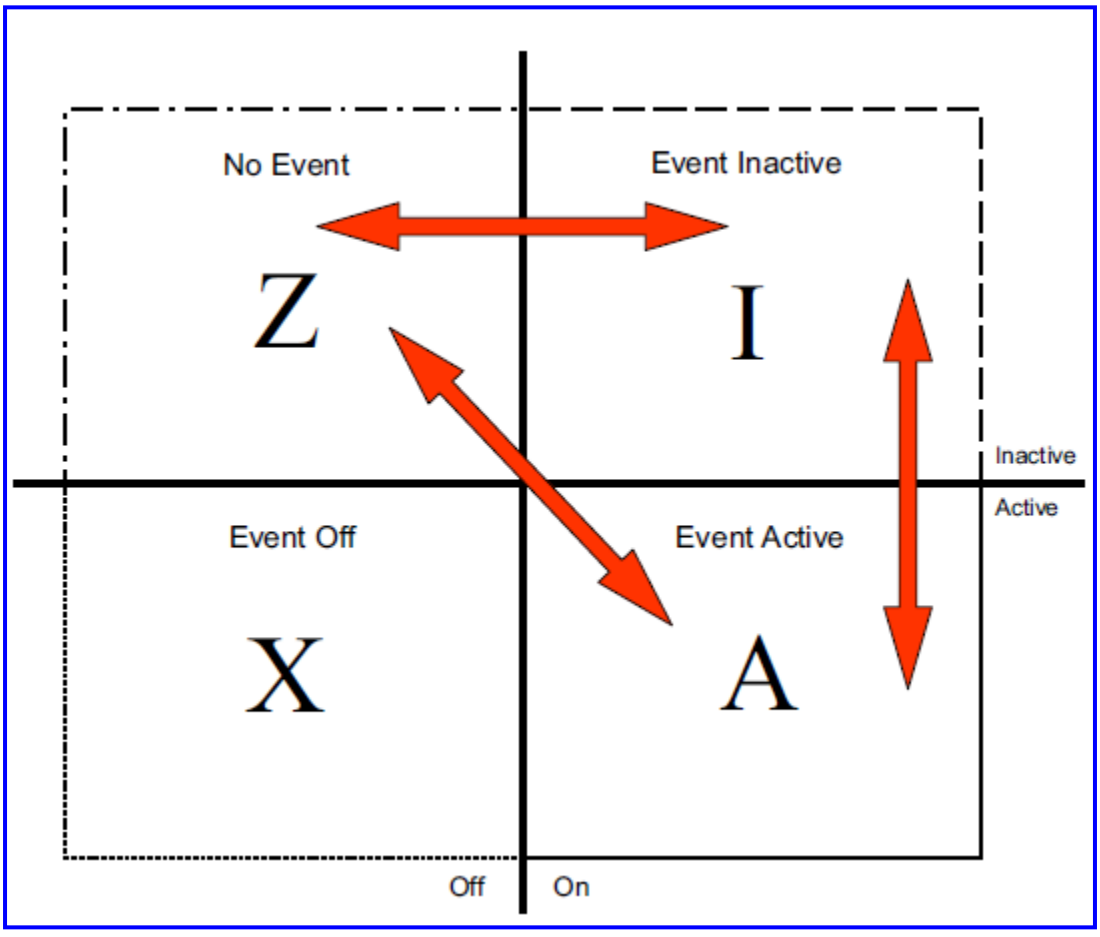
Generally, the signal cannot be switched into the "Inactive Signal" or "No Signal" states by any action on the signal. The signal is returned to the "No Signal" state only when it is destroyed, e.g., when it is no longer required. At that time, the signal may be considered to have passed momentarily through the "Inactive Signal" state.

The output of a signal carries its own event information: an active signal is equivalent to "Event Active," and "No Signal" is equivalent to "Event Inactive."

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

4.3 Event states

Figure 3 shows the states available to an event. Before an event exists, it may be considered to be in the "No Event" (Z) state. When it is invoked, it passes into the gated on state, but may be active or inactive. An event may change between active and inactive while gated on. Signals may be gated on and off by an event as explained in 3.2. Other events may be gated on and off by an event, and as shown in Figure 3, these other events are switched between the "No Event" state and either the "Event Inactive" or "Event Active" state, as appropriate.



(New)

Figure 3 —Event states

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

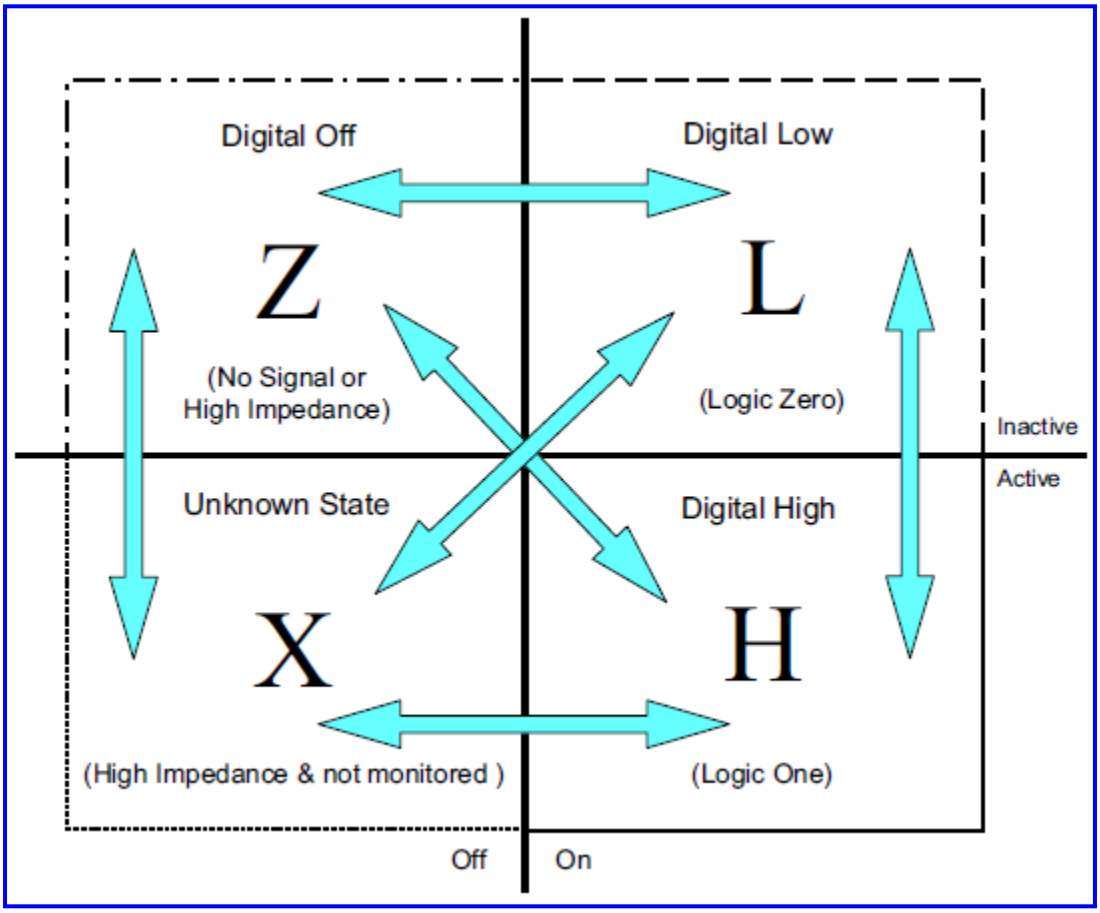
When used to gate a signal, there is very little difference between an event in the "No Event" state and the "Event Inactive" state; either of these will effectively gate the signal off. Only the "Event Active" state will gate the signal on. The difference is apparent when gating an event such as a NotEvent. A NotEvent changes an "Event Active" state at its input to an "Event Inactive" state at its output, and vice versa. Gating a NotEvent will change its output between "No Event" and the appropriate "Event Active" or "Event Inactive" state.

The fourth state, "Event Off," may be considered not to exist for an event source.

4.4 Digital stream states

Figure 4 shows the states available to elements of a digital stream. When there is no digital signal, it may be considered to be in the "Digital Off" state. A digital stream, whether serial or parallel, may comprise a series of H, L, X, and Z characters, which represent the usual digital states as shown in Figure 4.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012



(New)

Figure 4 —Digital stream states

A “Digital Off” (Z) state indicates that there is no signal. The “Digital High” (H) and “Digital Low” (L) states represent the normal two digital states (0 and 1). The “Unknown State” (X) represents the fact that a digital signal is present, but it is not possible to know what it is. It is not driving a 1 or 0 when used as a stimulus, and it is not monitored when used as response information (a “do not care”). Both the X and Z states will be represented by an X (Signal with No Value) state when converted into a physical signal, usually in the form of a high impedance output.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

It is important to note that Figure 4 applies only to digital stream information. After a digital stream has been converted into a physical signal, the description in 3.2 applies.

5. ~~Signal modeling language (~~SML~~)~~ layer

The SML layer provides ~~allows~~ the definition of signals, both analog and digital, as well as their functions in any number of domains. It provides this capability by giving a number of predefined behaviors that can be combined as necessary to produce the desired signal definition. This clause describes the use of SML to define signals, the measurement of signal parameters, and the conditions that a signal must meet.

The SML provides an exact mathematical definition for each BSC, in terms of dependant and independent variables, by using the de-facto functional programming concepts of Haskell [B7]. Each definition represents the functioning of a component ~~an entity~~, which is a requirement for ~~component~~ use and reuse. This representation is accomplished by giving a formal definition of the syntax and predefined signals. An execution mechanism may be provided for simulating the modeled signal, plotting against its definition domain, and measuring its various properties. Within the SML layer, the type of a signal is known as the dependant variable, and the reference type is known as the independent variable.

6. ~~Basic signal component (~~BSC~~)~~ layer

Clause 6 describes the methodology adopted to define signals with BSCs and the mechanisms by which they may be combined and synchronized.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

6.1 BSC layer base classes

All BSC classes used to define signals are derived from the SignalFunction class. BSC classes define their properties using one of the base classes shown in Table 1 or using traditional programming types. This class approach is useful for categorizing BSCs according to their characteristics, behavior, and interfaces.

Table 1 —BSC base classes

Base class	Description
SignalFunction	The base class of all BSCs
Signal	Allows BSCs to exchange information
~~Resource~~	~~Creates the BSC objects~~
PulseDefns	Defines a group of pulses
Physical	Real, dimensioned signal values

6.2 General description of BSCs

BSCs are the fundamental components of this standard. The BSCs are the building blocks used to define more complex signals and cannot be decomposed into simpler components.

BSCs are used to build signal models, which define the required signal. A signal model can contain a single BSC to define a simple signal or combined BSCs to define a more complex signal.

BSCs can be used to either define static signal models or perform dynamic signal programming by programmatically changing signal models through a programming language.

Signal models represent static signal descriptions, where the signal model does not change over time ~~(i.e., reference type)~~. The BSC control interface (i.e., the IDL description) can also be used to define dynamic signal definitions, where the value of the attributes or the signal model changes while the signal is being used.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

The signal described by a signal model can be used to create a source signal or to measure a signal characteristic attribute.

Unless otherwise stated, the default reference type for a BSC is Time; and where required, the default signal type is Voltage.

Each BSC is described using object orientation terminology as follows:

a) A class derived from SignalFunction base class (or subclass)

b) Class type and reference type description

c) Attributes and default values

d) A control interface (defined using an IDL description)

e) A formal SML description

f) An XSD entry

The following annexes describe BSC features:

— Annex A gives details of the BSC formal SML descriptions.

— Annex B gives details of the BSC classes and attributes.

— Annex C gives details of the dynamic signal model behavior.

— Annex D gives a list of the IDL descriptions for each BSCs.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

— Annex I gives a list of the XML descriptions for mapping signal models.

NOTE—Annex D and Annex I are normative annexes in that they provide the normative descriptions for the BSCs in IDL and XML, respectively. ~~This does not mean that the~~ BSCs may also ~~not~~ be described in other interface languages.[3]

6.3 SignalFunction template

A template is used as document shorthand to define types of derived classes of SignalFunction, where each class has similar behavior and supports the same IDL description, but describes signals of different types. Note that the class name is always the same; only the class type changes.

The use of the template defines alternative class types, where each derived class name could equally have been written using "cut & paste" and replacing the keyword "type" with any physical class defined within this standard. Substituting <type:…[,ref:…]> with each alternative creates the class type that the template defines. The specific type alternatives provided in the template identify the more commonly used signal classes; once the template is defined, any type or reference can be used.

The format for the template header is as follows:

ClassName<**type**:typeName[||typeName]*[,**ref**:typeName[||typeName]*]>

Where no explicit types are provided, the default type is Voltage, and the default reference type (ref) is Time.

For example, **Sinusoid**<type:**Voltage**||**Current**||**Power**> defines the following classes, where each class supports the **Sinusoid** interface, through the IDL definition:

a) Sinusoid (Voltage) full type: Sinusoid (Voltage, Time)

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

b) Sinusoid (Current) full type: Sinusoid (Current, Time)

c) Sinusoid (Power) full type: Sinusoid (Power, Time)

NOTE 1—Alternatives are separated by the double-bar characters (‖).

NOTE 2—This template convention is adopted in the remainder of this standard.

7. ~~Test signal framework (~~TSF ~~)~~ layer

The TSF layer describes how BSCs are combined into more complex signals and packaged for reuse in TSF libraries.

The TSF layer also provides a packaging mechanism for grouping signal models into library elements. These libraries are constructed from individual TSF classes where each class defines ~~supplies~~ an interface ~~definition in IDL and~~ , a ~~static~~ signal model, and textual description. A TSF library will generally be a collection of domain-specific signal definitions.

All ~~If the TSF class is to be used utilizing the XML descriptions in the Require method or TPL setup statement, then the~~ TSF classes shall exist in an XML TSF library conforming to Annex I. Additional support documentation and interface files may also be provided.

7.1 TSF classes

A TSF IDL library shall be defined in terms of an IDL library module ~~and~~, will contain an entry for each TSF class within the library domain, and shall be derived from the XML TSF library.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

A TSF class shall be defined with a valid XML TSF element utilizing the attribute model and description elements.

~~A TSF class shall define the IDL definition for its class and its attribute interface.~~

A TSF class model shall be described only as a static signal model and may contain elements from the following:

— BSCs

— Other TSF classes

— Reference to the TSF class being defined

A TSF class's signal description utilizing a TSF component is identical to a signal description incorporating the complete TSF static signal model. As such, the following statements are generally true:

— A TSF component output is available only when its Gate (see Annex B) event is on.

— A TSF component restarts its operation when its Sync (see Annex B) event arrives.

TSFs provide the extendibility mechanism that allows the user community to create additional signal class definitions.

There is no difference between a TSF class built from BSCs only and a TSF class built from BSCs and/or other existing TSF classes. The resultant signal from a TSF class is determined by the operation of all its components down to the lowest level (i.e., BSCs).

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

When a TSF signal model makes references to itself, it creates a recursive signal model definition. In this case, the TSF is regarded as a signal transform, where each iteration is providing a more accurate signal. The actual number of iterations required is reflected by the accuracy of the signal required or uncertainty of the measurement. To be a proper signal model definition, the TSF signal transform should be convergent.

Use of self-referencing models that contain a reference to themselves and are not convergent (e.g., RS232) is deprecated and maintained for support of the earlier edition of this standard. Such TSF definitions should now be defined by an external reference (see 7.3).

7.2 TSF signals defined by a model

Each signal described in a TSF may ~~shall~~ have the following information:

- Title, which indicates the syntax of the TSF class name ~~(in upper case characters with underscores)~~.
- Definition of the signal.
- Model diagram, which shows the component parts of the signal and their relationship. This diagram is provided to give a convenient pictorial representation of the signal model. In the event of any conflict between the model diagram and the model description table, the model description table takes precedence.
- Interface properties table listing the TSF interface properties.
- Notes as needed for any additional explanations.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

— Model description table, which lists the component parts of the signal and their relationship. Each element in the model is supported by a definition in the BSC.

— Equations as needed to define the operation of the model.

— Rules as needed relating to the operation of the model.

7.2.1 Interface properties table

The interface properties table shall comprise ~~of~~ the following five columns:

— *Description*. The descriptive name of the attribute.

— *Name*. The syntactical name of the attribute as defined in the BSC.

— *Type*. The attribute type as defined in the BSC. If the type is given as physical, the actual type shall be chosen from the list provided with the signal title. If more than one attribute has the type given as physical, then all attributes shall be of the same type.

— *Default*. If a value is provided, the default is the value that the attribute will take if the attribute is not specifically defined. If no default value is given, then the user shall provide a value.

— *Range*. If a range is given, it indicates the valid range for the attribute. The attribute value must fall within this range.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

Table 2 shows an interface property table for a sample signal (in this example, AC_SIGNAL). It indicates that the user should provide the physical type, amplitude, and frequency as a minimum. The physical type is usually determined from the units given with the value; for example, an amplitude of 10 V indicates that the physical type is Voltage. If no DC Offset or initial phase angle is defined, each attribute will assume the default values given in the table. Note that the DC Offset is of the same type as the AC Signal amplitude.

Table 2 —Example of TSF interface property table

Description	Name	Type	Default	Range
AC Signal amplitude	ac_ampl	Physical	—	—
DC Offset	dc_offset	Physical	0	—
AC Signal frequency	freq	Frequency	—	—
AC Signal phase angle	phase	PlaneAngle	0 rad	0 – 2π rad

An attribute of a TSF class that is subsequently not used in the signal model description cannot be used to change or control the signal. It may be used to describe the capabilities required from the signal; for example, if an attribute Distortion Max 3% were added to the interface, it would mean that distortion must be less than (or equal to) 3%. As such, all such capability attributes are optional.

7.2.2 Model description table

The model description table describes the signal model using a network list format. The model description table shall comprise ~~of~~ the following six columns:

— *Name*. The given name of the BSC or TSF within the model.

— *Type*. The type of the BSC or TSF.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

— *Terminal*. The terminal names of the BSC or TSF, usually in the order of outputs followed by inputs.

— *Inputs*. The signal or attribute that is connected to the terminal listed in the "Terminal" column.

— *Output*. The output(s) of the BSC or TSF. Some BSC or TSF signal outputs will be inputs to other BSCs or TSF signals within the model, and at least one will be the output from the model.

— *Formula*. An optional mathematical definition (or constant value) of the function or input. Where the formula references another attribute from within the TSF model, the formula value should be evaluated every time the reference value changes. The implicit translation from one type to another shall be the natural translation between the types supported by the expression handler defined.

Table 3 shows a signal model for AC_SIGNAL. A BSC of type Sinusoid (named AC Component) is summed with a BCS of type Constant (named DC Offset) to create the AC_SIGNAL.

Table 3 —Example of TSF model description table

Name	Type	Terminal	Inputs	Output	Formula
AC Signal	Sum	Signal [Out]	—	AC_SIGNAL	—
		Signal [In]	DC Offset	—	—
		Signal [In]	AC Component	—	—
AC Component	Sinusoid	Signal [Out]	—	AC Signal	—
		amplitude	ac_ampl	—	—
		frequency	freq	—	—
DC Offset	Constant	phase	phase	—	—
		Signal [Out]	—	AC Signal	—
		amplitude	dc_offset	—	—

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

7.2.3 TSF figures

Each TSF figure provides a pictorial description of the model description and interface properties. These figures give an intuitive representation of a signal model, which is based on the BSC diagram (see Figure B.1). They do not infer the use of any specific signal resources. If the TSF figure is not consistent with the model description table or the interface properties table, then the tables take precedence. The external interfaces and properties are illustrated in the same manner as for an individual BSC (see Figure B.1). The internal structure shows how BSCs and other TSF components are combined to provide the required signal. See Annex E and Annex F for examples of TSF figures.

7.2.4 Other properties

A TSF may also have additional properties that are not used directly in the TSF model. They may be used to describe qualitative properties such as capability attributes, which provide additional information about a signal (to help select an appropriate instrument) but do not modify the signal.

TSFs may have two attributes that have significance only within a TSF library:

— Hidden, which indicates that the TSF is available for use only by other TSFs within the library, i.e., it is hidden from use and cannot be used directly outside the library. To hide a TSF, set the Hidden attribute to true.

— Group, which provides the facility to indicate that a set of TSFs is part of a single group. TSFs are considered to be in the same group if their Group attributes have the same name. Subgroups can be introduced by using concatenated group names separated by a colon (:), e.g., "group1:subgroupA."

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

All attributes used within a TSF shall have their Type defined. In the event that the Type of an attribute is left undefined, it shall be assumed to of Type xs:string.

7.3 TSF signals defined by an external reference

A TSF may be defined by an external reference such as an internationally recognized standard. If this method is used to define a TSF, the reference must be complete and explicit with a full source reference.

Any attribute names used must be defined in the external reference or fully described in terms of elements in the external reference.

8. Test procedure language (TPL) ~~layer~~

The TPL (see Annex H) ~~layer~~ provides a mechanism for users who want to document test requirements in a textual format. The use of the TPL to write test requirements is analogous to using ~~C/~~ATLAS inasmuch as the TPL uses stylized English signal statements to describe tests and to manipulate signals. It differs from using ~~C/~~ ATLAS in that it does not provide a fully defined programming language. Instead, STD allows users to adopt their own preferred programming language in which the signal statements and the underlying semantics of tests can be written.

8.1 Goals of the TPL

The goals of the TPL are as follows:

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

a) Its keywords have meanings that are normally accepted by the worldwide testing community.

b) It is an effective means for communicating test information relating to the testing of a UUT between an originator of a test requirement and an implementer of a test requirement.

c) Test requirements written according to the TPL rules shall be portable to implementations on different designs of test equipment that have the same testing capability no matter how it is controlled.

8.2 Elements of the TPL

The TPL requires ~~comprises~~ two elements:

a) Signal statements, which are used to configure, manipulate, control, and measure signals.

b) Carrier language, which is a programming language in which the signal statements can be written, sequenced, observed, and generally supported.

8.3 Use of the TPL

To produce test requirements using the TPL, users shall embed the test statements in their preferred carrier language.

Users must recognize that there must be some translation mechanism to convert from this neutral format of the signal statements into their preferred carrier language format before the test statements can be compiled and executed.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

Use of a translator to convert the neutral representation of the test statements into the carrier language format offers certain benefits in that parameter type checking and semantics checks can be conducted prior to test execution.

9. Maximizing test platform independence

The use of this standard allows signal definitions to be created without reference to their final application. This approach in turn facilitates the definition of test requirements that provide the ability to achieve test application interchangeability across different test platforms. This best practice is encapsulated in Annex K, where a set of rules that should be followed when developing test applications is defined.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012

Annex A

(normative)

Signal modeling language (SML)

A.1 Use of the SML

In general, unless a user needs to generate new keywords for the test methodology, there is no requirement for a user to refer to the SML in order to generate test requirements for a unit under test (UUT). Occasionally, a user may need to refer to the SML either for the mathematical justification or simulation of some signal construct or for the introduction of a new keyword to cover some new test application that the test methodology does not embrace. In the latter instance, a user will need to refer to the SML in order to ensure that any new keyword that is introduced into the test methodology is coherent with the existing predefined keywords. The purpose of this step would be to submit a proposal for future releases to the standard.

For the convenience of using processing software suites that are freely available without any restrictions to generate the signal diagrams, a derived version of the functional programming language Haskell [B7] has been adopted.

NOTE—The blocks of SML code defined in this annex are preceded and followed by a blank line. Each line is continuous starting at the ">" symbol. Code often appears to flow onto a second or subsequent line due to the restricted line length of a published standard. When the code is used with a Haskel compiler, the lines should be reinstated as continuous starting at the ">" symbol. Care should be taken to ensure that the ">" (start of line) symbol is not confused with the "->" symbol.

Documents
Document Sharing Hub
Authorized licensed use limited to: Tsinghua University. Downloaded on February 25,2026 at 20:57:50 UTC from IEEE Xplore. Restrictions apply.
Full document details: IEEE 62529-2012